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Leveraging AI in education in Cambodia: A review of perceived concerns and associated benefits

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Abstract: With current state-of-the-art advances in artificial intelligence (AI), especially large language models, such as Google's Gemini, Microsoft's Copilot, and ChatGPT, among others, a plethora of research on this phenomenon has been conducted worldwide aiming to examine its limitations, benefits and ethical implications. Nonetheless, such a phenomenon has been rarely discussed and researched in the contexts, such as Cambodia. In light of this, this article aims to discuss perceived concerns and associated benefits of using AI in Cambodia's education by extensively synthesizing various types of articles–research articles, opinion pieces, online newspapers, and other relevant documents. Based on a comprehensive review of the secondary sources, the article identified five perceived concerns related to the use of AI in Cambodia's education, including privacy and security issues, decline in critical thinking and creativity, risks of academic misconduct, assessment issues, and superficial and biased information. Despite these concerns, the article also underscored a range of benefits, such as offering personalized learning, enabling better innovative assessment and pedagogy, supporting and enhancing productive administration, and providing academic writing support. The article begins by examining the perceived concerns surrounding the utilization of AI in education in Cambodia first, then it moves to the discussion of the associated benefits. The article ends with a conclusion by summarizing the key findings before calling for future research regarding the use of AI in the Cambodian context.

Keywords: Artificial intelligence (AI), associated benefits, perceived concerns, education, Cambodia, large language models (LLMs), personalized learning, ChatGPT, academic misconduct, AI-powered tools

Highlights

What is already known about this topic:

- Generative AI can process, contextualize, interpret, analyze, and use human languages.
- Recent AI advancements, large language models, like ChatGPT, have extensively sparked debate on the potential limitations, perceived benefits, and ethical implications.

What this paper contributes:

- This article discusses the perceived concerns and associated benefits in terms of the use of AI-driven tools in the realm of education in Cambodia.
- The article identifies five potential concerns about the adoption of AI-powered applications in Cambodian education: privacy and security issues, dismissed critical thinking, and creativity, academic misconduct, assessment issues, and falsified information.
- The article underscores the benefits of the utilization of AI-powered applications in Cambodian education, such as providing personalized learning, fostering innovative assessment, and pedagogy, improving productive administration, and offering academic writing assistance.

Implications for theory, practice and/or policy:

- The review article highlights the need for Cambodian stakeholders, including educational leaders and policymakers, to ensure the ethical, effective, inclusive utilization of AI-powered tools in education.
- The article suggests further research on the adoption of AI-powered tools in Cambodian education, specifically in K-12 education, and teacher education, to investigate teachers' and students' perceptions related to the challenges, opportunities, and pedagogical implications.

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Introduction

The rapid progress and widespread deployment of artificial intelligence (AI) has garnered immense public interest in its exponentially powerful capabilities in recent years (Bower et al., 2024; Pang et al., 2024; Sol & Heng, 2024). Indeed, AI has been leveraged in various fields, ranging from education and health sciences to business and agriculture (Ng et al., 2021; Sol & Heng, 2024). The emergence of ChatGPT in late November 2022 has pushed AI to become more debatable over its positive and negative effects on society (Strzelecki et al., 2024). In the educational landscape, given the profoundly potential impact of AI on varying aspects of education, particularly teaching, learning, and administration, this phenomenon has been globally studied (Chiu et al., 2023; Rodway & Schepman, 2023; Sok & Heng, 2024b; Sol et al., 2024; Xiao, 2024).

Extant research into AI in education has shown both pitfalls and benefits (Ahmad et al., 2024; Chan & Hu, 2023; Chiu et al., 2023; Sok & Heng, 2024b). As found by various studies, the use of AI in education can provide a variety of benefits, including, but are not limited to, improved pedagogical practice (Okagbue et al., 2023; Sok & Heng, 2023), enhanced assessment practice through automated grading, and adaptive and rapid feedback (Yan et al., 2023; Zhang & Tur, 2023), fostered individualized learning (Bozkurt & Bae, 2024; Zhang & Tur, 2023), better support in brainstorming ideas and structuring writing (Chan & Hu, 2023; Sok & Heng, 2023; Sol & Heng, 2024) and better support on administrative work (Dimitriadou & Lanitis, 2023; Sok & Heng, 2024b). In this sense, AI has a significantly integral role to play in supporting and fostering learning-teaching and administrative processes. For example, Sok and Heng (2024b) conducted a comprehensive review with 52 articles showing that while multiple concerns were raised, the use of AI, such as ChatGPT, in higher education presented a wide range of benefits. Key benefits included, among others, virtual learning assistance, assessment, and pedagogical innovation, support in the process of designing and developing research, support in academic writing, and enhancement of administration and productivity.

Despite these considerable advantages, recent studies have indicated that leveraging AI-powered tools in education raised a number of unprecedented drawbacks which included superficial or misleading outputs produced by AI (Chan & Hu, 2023; Pang et al., 2024; Grájeda et al., 2024); academic dishonesty–cheating, and plagiarism–leading to academic misconduct (Cong-Lem et al., 2024; Sok & Heng, 2024b; Xu et al., 2024); assessment issues due to potential bias (Sok & Heng, 2023; Sok & Heng, 2024b); and reduced creativity, leadership, critical thinking, and problem-solving skills caused by excessive dependence on AI (Alotaibi, 2023; Chan & Hu, 2023; Cong-Lem et al., 2024). In particular, a systematic scoping review with 118 articles by Yan et al. (2023) revealed that despite a range of benefits being identified while integrating AI-driven tools in education, significant pitfalls were found. Key pitfalls included “low technological readiness, lack of replicability and transparency, and insufficient privacy and beneficence considerations” (Yan et al., 2023, p. 90). Therefore, it is obvious that while the use of AI-powered applications in education provides considerable benefits, various concerns are simultaneously presented–requiring relevant stakeholders to cautiously integrate these sophisticated applications in teaching and learning to maximize opportunities.

In the context of Cambodia–one of the developing countries in Southeast Asia, the education system has been noticeably improved in recent years (Sok & Heng, 2024c). However, research and publications related to educational technologies, particularly AI in education, appeared to be underexplored in international literature. Recently, the Ministry of Education, Youth, and Sport has urged Cambodian teachers to explore the use of AI-powered tools to foster learning-teaching quality (Khmer Times, 2024). Specifically, while AI-enabled tools or applications were allowed to use in Cambodia due to their significant benefits, researchers and experts have underscored their concerns about unethical and irresponsible utilization, such as cheating, and academic plagiarism, which could result in breaches of academic integrity (Cambodianess, 2023; Sok & Heng, 2024a). Given these rising concerns, Sok and Heng (2024a) have urged Cambodian higher education institutions to establish an academic integrity

policy along with appropriate guidelines or revise the current ones. The goal was to address the unethical or unreasonable usage of AI in education and to promote the responsible, ethical, and inclusive adoption of AI-powered tools in the realm of education in Cambodia (Sok & Heng, 2024a).

Given the substantial rise of AI-powered tools and the lack of empirical studies on this phenomenon in the Cambodian context (Sol et al., 2024; Sok & Heng, 2024a), this article included varying forms of articles and documents for the review in order to gain comprehensive insights associated with AI use in Cambodia. Its aim is to discuss the perceived concerns and associated benefits of leveraging AI in education in Cambodian context. This review is significant, as its findings offer practical and theoretical insights pertaining to the drawbacks and benefits of employing AI-enabled tools in Cambodia's education to academic leaders, teachers, policymakers, and researchers. The perceived concerns of the deployment of AI-powered tools in education in Cambodia are discussed first, then the discussion moves to the associated benefits. It finally concludes with a summary of the key findings before providing directions for future research.

Research Method

Document analysis was employed as a research method for this review article (Creswell, 2009). According to Bowen (2009, p. 27), document analysis is defined as a "systematic procedure for reviewing or evaluating" both online and printed documents. This method is associated with skimming–reading quickly to receive general meaning or information, interpreting, and reviewing–examining in detail (Bowen, 2009). It involves analyzing varying forms of documents which include newspapers, scholarly articles, books, and reports, among others (Morgan, 2022). Therefore, this method is deemed suitable for this review article, given that this current study aims to include a range of documents for the review to establish comprehensive findings with regard to the usage of AI-enabled tools in Cambodian education.

This review was guided by the following methods. First, a range of databases (e.g., Google Scholar, ResearchGate, and local websites) were used to assess and identify relevant articles and documents. To achieve adequate documents for the review, several keywords were utilized in our searches, including, among others, challenges or concerns of using AI in Cambodian education, and opportunities or benefits of using AI in Cambodian education. Alongside these searches, other synonyms were also utilized, such as drawbacks, negative impacts, positive impacts, and the adoption of AI in Cambodian education. However, it is of paramount importance to note that the searches were limited to the Cambodian context only; that is, articles outside of Cambodia were excluded from the review. Second, the inclusion criteria were established to ensure the comprehensive review related to the perceived concerns and associated benefits of leveraging AI in Cambodian education.

Table 1: Eligible inclusion criteria

No.	Eligible inclusion criteria
1	Written in Khmer and English
2	Published from 2022 to June 2024
3	Discussed the AI in education in the context of Cambodia
4	Published in any type of articles (e.g., research articles, review articles, opinion pieces, newspaper articles, commentary articles, survey reports, books, and government documents.

Following the inclusion criteria, as can be seen in **Table 1**, there were a total of 16 varying forms of articles included in this review. Considering data analysis, the included documents were critically reviewed by both authors to identify key themes and sub-themes. As a result of familiarizing with all the data, two main themes were identified: (1) perceived concerns of leveraging AI in education in

Cambodia, and (2) associated benefits of leveraging AI in education in Cambodia. Alongside that, five sub-themes (e.g., privacy and security issues, reduced critical thinking and creativity, academic misconduct, assessment issues, and inaccurate and biassed information) were identified and grouped under the first theme while the other four sub-themes (e.g., offering personalized learning, enabling better innovative assessment and pedagogy, supporting and fostering productive administration, and providing academic writing assistance) were grouped under the second theme. It is paramount to note that the themes and sub-themes in this review were identified based on the frequency of patterns in all reviewed documents.

Findings and Discussion

The sections below discuss the main findings grouped under the themes of perceived concerns of leveraging AI in education in Cambodia, and associated benefits of leveraging AI in Education in Cambodia.

Perceived concerns of leveraging AI in education in Cambodia

Through the critical synthesis related to the use of AI-powered tools in Cambodian education settings, there are a variety of concerns discussed in different types of articles. These include privacy and security issues, reduced critical thinking and creativity, academic misconduct, assessment issues, and inaccurate and biassed information. The details of each concern are discussed in the following sections.

Privacy and security concern

Similar to global contexts, leveraging AI-powered tools in Cambodian education has raised considerable concern, prominently regarding privacy and security among educational stakeholders, particularly students (O'Connell, 2024; Sol et al., 2024). In particular, Sol et al. (2024) found that students demonstrated profound concerns in terms of data privacy and security when using AI-driven tools in their learning process, due to limited training on ethical and proper use of AI-driven tools, and a lack of confidence in using those sophisticated tools in their learning. In particular, given the extensive amount of data from teachers and students, the utilization of AI-powered tools in education raises a significant concern about where those data are collected, stored, and analyzed (O'Connell, 2024). The balance between the adoption of AI for educational insights and the protection of student privacy can undoubtedly be challenging–requiring vigorous and sufficient solutions (O'Connell, 2024). Given these associated risks, Cambodian academics held a forum, under the theme of “ChatGPT: Opportunities and Challenges,” seeking to discuss the benefits and risks regarding the use of AI, such as ChatGPT, involving approximately 100 participants (e.g., students, academia, researchers, among others) (Kiripost, 2023a). The common concern was associated with legal risk—copyright due to potential illegal and unethical outputs generated by generative AI (Kiripost, 2023a). Hence, it is imperative for school leaders and AI developers to explore a better approach to address this associated risk, and therefore optimizing the advantages of the world of generative AI.

Reduced critical thinking and creativity

As students can be overly reliant on AI-powered tools, they may not engage in critical thinking and creativity while using these advanced tools in their learning process (Cambodianess, 2023; Heng, 2023). Indeed, when students are excessively reliant on using AI-powered tools, such as ChatGPT, in learning without actively engaging in critical thinking, they are more likely to limit their creative skills and innovative ideas, given that these sophisticated tools could provide them with timely and constant answers without any effort made by the students (Cambodianess, 2023; Sol et al., 2024). This can lead to a decrease in analytics, innovation, and creativity among students (Sok, 2023). Similarly, AI-powered tools appear not to foster critical thinking among students, because these innovative tools provide students with direct answers, rather than enable them to engage in critical thinking and creativity (Heng,

2023; Sok, 2023). Noticeably, the Cambodian Information Technology (IT) experts have warned that the use of AI-powered tools may harmfully affect the quality of thinking, thus discouraging students from engaging in higher-thinking skills (Cambodianess, 2023). Therefore, it is obvious that AI-powered applications could limit students' abilities to develop independent thinking and decline their analytical thinking, and innovative ideas, which may, in the long run, have a detrimental effect on their learning and professional success.

Academic misconduct issue

While the current AI tools or applications have been widely utilized by Cambodian teachers and students in the teaching-learning process (Ministry of Industry, Science, Technology & Innovation, 2023; Sol et al., 2024), concerns in terms of academic misconduct have been widely presented (Chum, 2024; Heng, 2023; Sok, 2023; Sok & Heng, 2024a). Indeed, the ethical issue concerning the misuse of AI among students and teachers in higher education can cause academic misconduct related to plagiarism, and cheating which is of significant harmfulness in academic settings (Chum, 2024; Sok & Heng, 2024a). As Chum (2024) emphasized based on his professional experiences as a university lecturer in Cambodia for over 20 years,

> most students copy and paste someone's work to submit to their teachers as their original work without realizing that it is not only ethically wrong but could also face legal action concerning the Berne Convention for the Protection of Literary and Artistic Works 1886 and its amendment in 1979 that Cambodia ratified. (para. 15)

In this sense, it is imperative for Cambodian higher education institutions to ensure that AI-related policies and guidelines of ethical use with proper training are in place.

Assessment issues

As assessment is the backbone for the quality of all educational levels, leveraging AI-driven tools in education could create unfair assessments among Cambodian students. Sok (2023) argued that using AI-powered tools, like ChatGPT in education has the great potential to result in biased assessment, as students who utilize AI to generate their assignments may obtain a greater score than those of their counterparts. When AI-driven tools are utilized to generate assignments by students, it can indeed blur the lines between students' original work and AI-generated content–making teachers challenging to differentiate between the students' original tasks and AI-generated content (Sok, 2023; Sol et al., 2024). This would therefore discourage students to neither trust their teachers nor schools, especially in the Cambodian context, where learning outcomes appeared to be the students' top priority (Sok, 2023). Moreover, as the student uses AI tools to generate text and claim it as their own work, concerns have been highlighted related to breaches of academic standards. Therefore, there is a need for Cambodian teachers and educational leaders to carefully check and verify the students' submitted work to better promote fair and transparent assessment within the educational institutions.

Falsifying and biassed information

The rapid increase of AI has raised concern about the proliferation of misleading and biassed information–AI's responses in the process of teaching and learning in Cambodian contexts, as algorithms are likely to unintentionally increase biases and inaccuracies (Heng, 2023; Sol et al., 2024). As Heng (2023) noted, the answers produced by AI-powered tools, such as ChatGPT, may not always be entirely accurate, as AI systems are trained on extensive amounts of data; that is, when the data are biased, the AI system will be biased as well (Ministry of Industry, Science, Technology & Innovation, 2023). Similarly, Sol et al.'s (2024) study with English-major students (N = 328) across varying universities in Cambodia showed that students raised their concerns regarding the accuracy and

reliability of responses or outcomes produced by AI-enabled tools. In this sense, it is of paramount importance for students and teachers to verify the accuracy of answers or outputs obtained from AI-powered tools.

Associated Benefits of Leveraging AI in Education in Cambodia

Despite considerable concerns, there are a number of benefits of leveraging AI-powered tools in Cambodia's educational landscape. These include offering personalized learning, enabling better innovative assessment and pedagogy, supporting and fostering productive administration, and providing academic writing assistance. Each of these associated benefits is discussed in the next paragraphs.

Offering personalized learning

Due to the impressive capabilities and intelligence in nature of AI-powered tools, Cambodian teachers and students can use these tools for personalized learning (Jeganathan, 2024; Heng, 2023; Ministry of Industry, Science, Technology & Innovation, 2023; Soun, 2023). Specifically, AI-powered applications have enormous capacities to help analyze student's learning styles, interests, and strengths, as well as customize the content and pace of instruction to meet the students' varying needs (AMS, 2023a; O'Connell, 2024). This suggests that teachers can prioritize their time to work on other essential tasks associated with the improvement of teaching and learning quality (Jeganathan, 2024). Moreover, with personalized learning facilitated by AI-driven tools, Cambodian students have a better chance to develop their autonomous learning skills–being necessary for 21st century education (Soun, 2023). In addition, according to the survey by Heng (2023), Cambodian university teachers claimed that AI tools should be leveraged in higher education to not only search for general information, and assist with assignments or homework, but also to ask for timely and constant feedback. Noticeably, AI plays an integral role in assisting and fostering students' language learning. For example, Sol et al. (2024) study found that Cambodian university students used AI-powered tools, such as Grammarly to assist them in translating languages and checking grammatical errors, thereby accelerating their language acquisition. Sol et al. also underscored that the Cambodian students demonstrated a positive willingness to leverage AI tools (e.g., Google Translate, Grammarly, ChatGPT, and Quillbot) in their English language learning. Thus, it is evident that the use of AI-driven applications in Cambodian education contexts provides both teachers and students with personalized learning which may, in turn, maximize personalized learning experiences.

Enabling better innovative assessment and pedagogy

Given that innovative assessment methods and pedagogical approaches are essential for fostering student engagement, and enabling the quality of education, the use of AI-powered tools can help Cambodian teachers enhance assessment and pedagogical practices by creating innovative tests and designing engaging lessons for teaching (Sok, 2023). Indeed, AI could assist teachers in designing lessons that meet students' learning needs, establishing smart context, and automatically grading tests, as well as providing automated tutoring and categorizing learning difficulties (Ministry of Industry, Science, Technology & Innovation, 2023; Soun, 2023). Similarly, teachers utilize AI to search for general information, design course syllabi and lessons, and create classroom content (Heng, 2023; Sok, 2023). AI-driven tools can also be deployed to assist in generating codes, producing quizzes and exams, and detecting plagiarism (Heng, 2023; Kiripost, 2023b). A panel discussion organized by the AmCham ICT Committee in Phnom Penh, Cambodia, underscored the transformative teaching and learning approaches from conventional learning to AI-assisted approaches, which could promptly access and validate information (Cambodia Investment Review, 2024). Similarly, not only can AI assist teachers in various tasks, ranging from answering student questions to generating lesson plans, exercises, quizzes, and teaching resources but it also helps teachers analyze the students' writing with constant and timely feedback, and recognize students' varying level of knowledge (Heng, 2023; Jeganathan, 2024). It is

clear that leveraging AI-powered tools in education can benefit Cambodian teachers through enabling innovative assessment and pedagogical approaches.

Supporting and fostering productive administration

The integration of AI in educational administration in Cambodia holds significant promise for efficient administrative tasks, and enhanced decision-making processes. In particular, AI-driven applications can be deployed in various aspects of administrative work, ranging from automating scoring, and tracking students' attendance, to analyzing assessments and preparing academic schedules (Cambodia Property Report, n.d.; O'Connell, 2024). In this sense, leveraging AI in education has the profound potential to minimize teachers' workloads, thereby enabling them to focus on teaching and supporting student learning and engagement (Jeganathan, 2024). This increased efficiency is more likely to contribute to a more effective and productive educational experience for teachers, students, and administrative staff alike (O'Connell, 2024). This evidence suggests that the integration of AI-powered tools in education in Cambodia has the significant potential to support a range of administrative works– resulting in saving time and fostering administrative processes by providing better opportunities for educational staff to focus upon other important tasks to improve their working productivity.

Providing academic writing assistance

With the intelligent and impressive abilities of AI-powered tools, such as ChatGPT and Google's Gemini, it is undoubted that these sophisticated tools can be employed to assist Cambodian students in fostering their academic writing skills which is of paramount importance for their academic success. Sok (2023) argued that AI tools like ChatGPT have the potential to provide students with the opportunity to foster their academic writing skills. In particular, these AI-driven tools are able to support students in writing paragraphs and essays by providing academic word or phrase suggestions that fit with the students' contexts and help students check grammar errors in their writing (Sok, 2023; Sol et al., 2024; Soun, 2023). Moreover, these advanced tools can be utilized to assist students in analyzing topics and presenting key concepts, as well as brainstorming ideas and editing written content, which is advantageous for students to develop ideas and simultaneously accelerate their writing skills (AMS, 2023b; Sok, 2023). However, there is a need to deliver the training to students, as most Cambodian students have limited knowledge of the ethical and reasonable use of AI in the learning process (Sol et al., 2024).

Conclusion and Directions for Future Research

This paper has reviewed various types of articles, including research articles, opinion pieces, online newspapers, and other relevant documents, its aim is to discuss the perceived concerns and associated benefits in terms of the use of AI-driven tools in the realm of education in Cambodia. The review identified five potential concerns regarding the usage of AI-powered applications in Cambodian education, including privacy and security risks, a decrease in critical thinking and creativity, academic misconduct issues, assessment issues, and falsifying and biased information. Notwithstanding these concerns, the review also underscored a variety of benefits associated with providing personalized learning, enabling better innovative assessment and pedagogy, assisting and enhancing productive administration, and offering academic writing assistance. The findings suggest a great need for relevant Cambodian stakeholders, particularly educational leaders and national policymakers to address the profoundly potential issues identified in this review article to ensure that students, teachers, and administrative staff ethically, reasonably, and inclusively utilize AI-powered tools in education, particularly teaching and learning with safety, confidence, and productivity. There are some significant suggestions to navigate the identified issues.

Considering the lack of empirical research related to the utilization of AI in the realm of education in Cambodia, particularly in K-12 education, and teacher education settings, this paper calls for researchers and scholars to further conduct research to explore better pedagogical and practical approaches to leveraging AI-powered tools in Cambodian education. In this sense, it is suggested that future research should investigate teachers' and students' perceptions in terms of the challenges and opportunities of using AI-driven tools in K-12 education, and teacher education settings in Cambodia, as such research has been non-existent in recent literature. Moreover, while this current review revealed that AI-powered tools had substantial potential to offer better innovative pedagogy and assessment practices, empirical evidence was absent. Therefore, there is an urgent need for future studies to examine how advanced AI-driven tools could impact on pedagogical and assessment practices, and learning outcomes at all levels of education in the context of Cambodia, particularly in higher education, as most university teachers and students have been reported the utilization of AI-enabled tools in their learning and teaching process (see Heng, 2023; Sol et al., 2024). The findings of such research will provide better insights to policymakers, education leaders, teachers, and students for informed decision-making. Finally, research into the university teachers' perceptions and attitudes pertaining to the use of AI in education in the context of Cambodia is also recommended.

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